Chapter 21
Future Challenge: A Paradigm Shift in the Forestry Sector

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Abstract This chapter re-visits the facts and figures of previous chapters, augmenting the discussion with other relevant literature. It reviews trends in regional deforestation, human population growth, and demands for forest (tree) products; and provides an overview of common tree-based landuse and management systems and their potential contribution to expand the regional forest base and generate forest products and services. Emphasis is placed on the contribution of smallholder tree-based (agroforestry) systems, given their additional function of supporting rural livelihoods of the potential of smallholder agroforestry systems to contribute to sustainable forest management and rural livelihoods are identified and discussed. Enabling conditions, institutional and policy support, and market oriented strategies are all discussed as means to strengthen the development and productivity of smallholder agroforestry systems. Discussions on those topics are well supported with citations and lessons learned emphasizing the experience from the Philippines. The main message of the chapter is twofold: (1) a paradigm shift in the forest sector is required to recognize the contribution and importance of smallholder systems to achieve sustainable forest management objectives; and (2) there is a need to adopt more holistic and sustainable strategies to support and strengthen institutions and smallholder system development, including linkages with the market.

Keywords Environmental services, marketing, policy support, smallholder technology, tree plantation

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21.1 Introduction

The premise of this volume is that smallholder tree-based systems are efficient agricultural and natural resource production systems. Various papers included in this volume have amply demonstrated the common occurrence and sheer socioeconomic importance of smallholder systems. A prominent component of '*trees outside the forest*', smallholder tree-based systems are primarily 'planted' systems that rehabilitate or reforest marginal farmlands where agricultural crop production is no longer biophysically or economically viable. Smallholder tree-based systems also include forest-like systems where select priority species are integrated in natural forests. In either case, farmers cultivate trees to diversify production, produce products for home consumption, enhance income through market sales, and reduce risk. Smallholder systems tend to contain multiple species, produce multiple products, and are found in both rural and peri-urban areas. In some locations these systems are a major economic source of forest- and tree-products. In Kerala, India smallholder systems provide 83 percent of the state's wood production and up to 90 percent of its fuelwood production (FSO 1998 in FAO 1998). Sri Lankan smallholder systems produce 73 percent of the nation's timber and 80 percent of its fuelwood (Gunatilake 1994 in Gunasena 1999). Products produced in smallholder systems of Indonesia include rattan, forest honey, sandalwood, gaharu, damar, benzoin, rubber, cinnamon, cloves, nutmeg, coffee and candlenut (see Sunderlin et al. 2000; Rohadi et al. 2003; Dove 2004; Garcia Fernandez 2004). The importance of smallholder systems will only increase as the global forest resource continues to shrink and human populations expand. Yet, as discussed in the previous chapter, smallholder systems are excluded in formal definitions; lost in statistics; and overlooked in the legal and institutional framework of agriculture and natural resources. Additionally, smallholder systems could be more productive and profitable if the common barriers that limited their development were addressed in a systematic way.

In this final chapter we re-visit the facts and figures of previous chapters, with a focus on the importance, present contribution and future potential of smallholder tree growing in South and Southeast Asia. The main message is twofold: (1) a paradigm shift in the forest sector is required to recognize the contribution and importance of smallholder systems to achieve sustainable forest management objectives; and (2) there is a need to adopt more holistic and sustainable strategies to support and strengthen the development of smallholder systems and link them with the market. To set the context in terms of importance of smallholder tree growing, we first review trends in regional deforestation, human population growth, and demands for forest (tree) products. Following that review we describe current common tree-based landuse and management systems and their potential to contribute to the regional forest base and as sources of forest products and services. Emphasis is placed on the contribution of smallholder tree based systems to *sustainable forest management* and their contribution to expanding regional forest resources, producing forest products and services, as well as, forming a major contribution to local livelihoods for rural communities. Enabling conditions, institutional support and policy support that facilitation

the establishment of successful smallholder systems are reviewed. Strategies to transform traditional smallholder systems towards market-oriented systems that better serve public environmental and economic goals are also discussed. The chapter is concluded with lessons learned that stress experience from the Philippines and conclusions that support the chapter's main message. As often as possible we reiterate the relevance of previous chapters, including data and citations.

21.2 Forest Loss, Environmental Degradation and a Loss of Forest Services

The forest loss projections made in the *Food and Agricultural Organization* (*FAO*) 1997 forestry sector outlook studies are clearly alarming. In the Asia-Pacific Region alone over 32 million hectares of *forests and woodlands* (*wooded lands*)[1] have been or will be lost by 2010; an additional 22 million hectares of *natural exploitable forests*[2] area, forests that can produce commercial timber, will be lost. These losses equal 3.8 and 8.5 percent of the respective 1995 area (Blanchez 1997). The projected loss is particularly distressing for Southeast Asia, where *forests and woodlands* area and *natural exploitable forests* area will decline by more than 11 percent and 14 percent, respectively, between the two benchmark dates. For South Asia respective losses are 2.5 percent of forests and woodlands and 8.6 percent for natural exploitable forests. While less severe than Southeast Asia, these rates of natural forest loss are very high and occur in a sub-region where the forest base is already greatly reduced from decades of unchecked forest conversion. The next FAO forestry sector outlook is in preparation and expected to be available December 2008 (see Nair 2006). An interim report (FAO 2005) documents an average annual net forest loss rate of 2.7 million hectares for South and Southeast Asia, which exceeds the dire projections made in the 1997 outlook study (Blanchez 1997). Since the net losses account for replanting and natural regeneration the actual rate of deforestation is undoubtedly higher.

Reforestation is being achieved through the expansions of forest plantations. Between 1995 and 2010 forest plantations are projected to increase by 21.0 million hectares (35 percent) across the Asia-Pacific region, by 6.0 million hectares (73 percent) in Southeast Asia, and 4.5 million hectares (30 percent) in South Asia (Blanchez 1997). Forest plantations are an important and efficient source of wood and non-wood products. The systems reduce production pressure on natural forests, and may have a tempering effect on the rate of natural forests loss. Globally, forest plantations

[1] *Forests* are areas with wild flora, fauna and natural soil conditions; with a minimum crown cover of 10 percent. *Wooded lands* compose of forest fallows (all complexes of woody vegetation derived from clearing natural forest for shifting cultivation) and shrubs (vegetation types where the dominant woody elements are shrubs of more than 50 cm and less than 5 m in height in maturity).

[2] *Natural exploitable forests* are natural or semi-natural forests, composed of tree species known to be indigenous to the area, that are commercially productive and economically accessible/available for timber wood supply. Legally protected and economically restricted forests are excluded.

account for roughly five percent of forest-cover, but yield 35 percent of the world wood supply. However plantations, which are primarily monocultural systems of exotic species, are inferior to primary and secondary forests in supporting genetic- and bio-diversity, ecological resilience, economic and social services to rural communities, water and soil conservation, and carbon storage (Michon and de Foresta 1995; Lamb 1998; Murdiyarso et al. 2002; Roshetko et al. 2007a; van Weerd and Snelder, Chapter 16, this volume; van Noordwijk et al., Chapter 20, this volume). Additionally, forest plantations are frequently established by clearing primary or secondary forests (Barr et al. 2004; Sheng and Cannon 2004), thus being a direct cause of natural forest loss. Although tree plantations will expand, they will remain a portion of regional forest base in South and Southeast Asia accounting for only 5.9 percent, 16.6 million hectares (FAO 2005). Overall forest-cover – the combined area of forests and woodlands, natural exploitable natural forests, and forest plantations – remains in decline. Forest-cover is projected to decrease by 2.9 percent in the Asia-Pacific Region and by more than 10.5 percent in Southeast Asia. Forest-cover will remain static across South Asia as a result of India's large plantation expansion program, 3.75 million hectares between 1995 and 2010. The other countries of South Asia will each experience major forest loss (Blanchez 1997). Projected forest area losses and gains for the Asia-Pacific Region and individual countries in South and Southeast Asia are listed in Table 21.1.

Even if the projections above prove to be excessive, given the varied data on which they are built, the fact remains that the regional forest base is decreasing. The declining forest base, compounded by a shift from natural forest systems to plantations, will be accompanied by a loss of forest functions and services. The level of this environmental degradation becomes evident when looking at the changes in the status of various forest-related variables that are representative of functions such as biological diversity, forest health and vitality, and the productive, protective and socio-economic functions of forest resources (Table 21.4 and Photo 21.1). In the Asia region, forest carbon storage decreased by 10.5 Gt of carbon annually between 1990 and 2005 due to deforestation and forest degradation. The loss of primary forest at a rate of 1.5 million hectares per year during the same period has serious consequences for regional biodiversity. The high rate of forest loss is the result of deforestation and forest degradation, the latter primarily due to selective logging which alters natural primary forests to secondary forest (FAO 2006). Efforts to conserve forests and biological diversity are growing, as evident by an annual increase of 1.4 percent in the area of conservation forests (Table 21.4). Forests also suffer from fires (Photo 21.2), diseases and insect attacks, and other disturbances, which affect up to 93,000 ha per year. Data on forest disturbances are far from complete. The area of forests used for the production of wood and non-wood forest products declined by an average of 683,000 ha per year, while the area of productive forest plantations increased by 195,000 ha per year. Official figures on total wood removals during the period 1990–2005 suggest a regional decrease of about 3.6 million hectares per year (or two percent per year). The actual loss is likely higher as illegal wood removals and informal fuelwood collection are not included in the calculations (FAO 2006). Both the area of forest primarily designated for protection and the area of protective forest plantations have increased

Table 21.1 Projected change in forest area between 1995 and 2010 for countries in South and Southeast Asia

Country/region	Land area (000 ha)	Forest area 1995[a] (000 ha)			Projected forest area 2010[a] (000 ha)			Projected change 1995–2010[a] (%)		
		FWL[b]	*NEF*[c]	*PF*[d]	*FWL*	*NEF*	*PF*	*FWL*	*NEF*	*PF*
Bangladesh[e]	13,017	2,040	465	343	1,600	311	463	−22	−33	35
Bhutan[a]	4,700	2,916	1,242	24	2,730	1,149	54	−6	−7	125
Cambodia[f]	17,652	13,083	4,984	7	11,399	4,341	10,5	−13	−13	50
India[e]	297,319	82,464	21,935	13,250	82,044	20,613	17,000	−1	−6	28
Indonesia[g]	181,157	139,950	74,166	5,184	126,922	65,208	8,434	−9	−12	63
Lao PDR[f]	23,080	20,800	2,495	11	19,000	2,227	26	−9	−9	136
Malaysia[g]	32,855	20,327	11,255	155	15,556	8,510	305	−23	−24	97
Myanmar[f]	65,755	47,124	20,442	519	42,062	18,058	894	−11	−12	72
Nepal[e]	14,300	5,542	2,806	130	4,964	2,429	280	−10	−13	115
Pakistan[e]	77,088	4,050	1,273	865	3,388	859	1,240	−16	−33	43
Philippines[g]	29,817	12,577	2,202	761	10,125	1,605	1,511	−19	−27	99
Sri Lanka[e]	6,463	1,990	918	101	1,834	825	137	−8	−10	36
Thailand[f]	51,089	13,630	7,957	779	10,588	5,609	1,529	−22	−30	96
Vietnam[f]	32,550	23,084	3,052	1,050	22,122	2,794	1,950	−4	−8	86
Asia-Pacific	2,843,170	823,495	262,975	59,463	791,862	240,604	80,340	−4	−8	35

[a] From Blanchez 1997

[b] *Forests and wooded lands*: *forests* (with wild flora, fauna and natural soil conditions) with a minimum crown coverage of land surface of 10 percent and *wooded lands* composed of forest fallow (i.e., all complexes of woody vegetation deriving from the clearing of natural forest for shifting cultivation) and shrubs (i.e., vegetation types where dominant woody elements are shrubs with more than 50 cm and less than 5 m height on maturity)

[c] *Natural exploitable forests*: natural or semi-natural forests (composed of tree species known to be indigenous to the area) that are commercially productive and economically accessible and available for timber wood supply; forests with economic restrictions (environmental, access, health) and or legally protected are excluded

[d] *Plantation forests*: forests and forest tree plantations (i.e., industrial, communal or individual) established by afforestation or reforestation and covering at least an area of about half hectare (trees on road sides, canal banks and homesteads and also plantations of rubber, coconut and oil-palm are excluded)

[e] South Asia

[f] Continental Southeast Asia

[g] Insular Asia

Photo 21.1 Bridge along Marhalika highway collapsing as a result of high flow discharge in deforested areas in Isabela Province, the Philippines (©DJ Snelder)

Photo 21.2 Unsustainable strategies lead to forest loss and environmental degradation (©GA Persoon)

at an annual average rate of respectively 112,000 and 63,000 ha (Table 21.4). Forests within this category contribute to soil and water conservation and other sorts of protective functions. Positive trends are evident in private forest ownership (increased by 2.7 percent) and forest areas reserved for social services (increased by 0.8 percent), but in terms of land area these gains are miniscule.

Negative trends in the regional forest base are associated with a loss of forest functions and services. This is alarming as most of the world's population resides in Asia (FAO 2005; UNDP/UNEP/WB/WRI 2005). The decreases in forest area and accompanying accelerated shortages of forest products will affect both rural and urban populations throughout the region.

21.3 Population Growth, Economic Development and Demand for Forest Products

While the forest base will decrease, human population and economic development will grow, increasing the demand and consumption of forest and wood products throughout Asia and elsewhere. In 1995 South and Southeast Asia were home to, respectively, 1,109 million (23 percent of the world population) and 437 million (nine percent) people in 1995 (ADB 2004). Projections indicate that by 2010 populations will increase to 1,557 million (a 40 percent increase) in South Asia and 590 million (a 35 percent increase) in Southeast Asia, assuming medium fertility levels (Chipeta et al. 1998). Annual population growth for individual countries in South and Southeast Asia ranged between 0.8 percent in Thailand and 2.4 percent in Bhutan during 2000–2005. In 2005 *gross national income* (GNI) per capita varied between US$270 for Nepal to US$4,970 for Malaysia (Table 21.2). Increases in GNI between 2000 and 2005 varied between 17 percent for Nepal to 125 percent for Indonesia. Chipeta et al. (1998) project annual increases in *gross domestic product* (GDP) of five to eight percent throughout South and Southeast Asia. At such growth rates, it can be expected that the Asian middle class will double or triple in the next decade. It is expected that by 2010 the Asian middle class, excluding Japan, could number between 0.8 to 1.0 billion people, forming a middle class market segment to equal or surpass that of the US and Europe combined (Naisbitt 1995 in Chipeta et al. 1998).

Population and economic growth will increase the demand and consumption of forest products, which in turn will be reflected in expanded global trade of these products (Photo 21.3). According to FAO (2005) major Asian forest products traded in international markets include industrial roundwood (59 million cubic metres with 14 percent for export markets), wood-based panels (35 million cubic metres; 46 percent exports), sawnwood (32 million cubic metres; 25 percent exports), paper and paperboard (32 million cubic metres; 35 percent exports), and pulp for paper (16 million cubic metres; 17 percent export). Yet, the production and trade of forest products vary greatly across countries. Indonesia is by far the greatest producer of industrial roundwood (based on the 2002 data; see Table 21.3) but Malaysia is the largest volume exporter of industrial roundwood.

Table 21.2 Trends in annual population growth, gross national income (GNI) per capita and average net annual trade in forest products for various South and Southeast Asian countries

Country/ region	Population[a] (million)		Annual growth[a] (%)	GNI/capita[b] (US$)		Average annual net trade in forest products[c,d] ('000 US$)	
	1990	2005	*2000–2005*	*2000*[e]	*2005*[f]	*1990–1992*	*2000–2002*
Asia	1,415.4	1,848.7	n.a.	n.a.	n.a.	−14,208,400	−19,568,974
Bangladesh[g]	108.7	137.0	1.4	380	470	−17,581	−75,872
Bhutan[g]	0.7[h]	0.8	2.4	510	600[h]	7,119	−876
Cambodia[h]	8.6	13.8	1.9	290	430	41,705	7,374
India[g]	835.0	1,107.0	1.7	450	730	−547,290	−865,449
Indonesia	179.4	219.9	1.3	570	1,280	3,170,812	3,909,903
Lao PDR[h]	4.1	5.6	1.4	290	430	33,951	45,114
Malaysia	18.1	26.1	2.2	3,390	4,970	2,737,487	1,907,737
Myanmar[h]	40.8	55.4	2.0	n.a.	n.a.	291,461	231,529
Nepal[g]	18.1	25.3	2.3	230	270	−3,960	−1,514
Philippines	60.9	85.2	2.1	1,030	1,320	−134,026	−495,568
Sri Lanka[g]	16.3	19.7	1.3	890	1,160	−76,625	−86,884
Thailand[h]	55.8	64.8	0.8	2,010	2,720	−1,074,407	−301,270
Vietnam[g]	66.0	83.1	1.4	380	620	85,163	−117,044

[a]From ADB 2006

[b]GNI per capita (formerly GNP per capita) is the gross national income, converted to US dollars using the World Bank Atlas method, divided by the midyear population. GNI is the sum of value added by all resident producers plus any product taxes (less subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad

[c]Refers to the aggregate of all forest products, including industrial roundwood, fuelwood and charcoal, sawnwood, wood-based panels, wood pulp (including recovered paper), and paper and paperboard (see also Table 21.3); a negative trade value refers to a net expenditure derived from a net import of forest products whereas a positive value refers to a net income derived from a net export of forest products

[d]FAOStat 2007, Earthtrends Data Tables: Forest Production and trade 2005 at http://earthtrends.wri.org/datatables/index.php?theme=4 accessed 21 May 2007; World Resources Institute (WRI) 1994; FAO 2005

[e]From ADB 2004

[f]From World Bank 2007 at http://siteresources.worldbank.org/DATASTATISTICS/Resources/GNIPC.pdf

[g]Average of 1989–1991 consumption data

[h]From 2002 data

The relationships between population and economic growth and the demand, consumption, and trade of forest products are rather complex, with various other factors playing significant roles as well. Indonesia and Lao PDR have experienced enormous growth in population and per capita GNI; and realized net gains in terms of the financial value of their forest product trade during the period 1990–2002 (Table 21.2). Malaysia, Cambodia and Myanmar while all experiencing population and per capita GNI growth, showed substantial decreases in net financial gain from

Photo 21.3 Log transportation for trade from Malaysia to the Philippines (©DJ Snelder)

forest product trade during the same time period. The differences in trade trends can be explained in terms of access and availability (abundance or scarcity) of harvestable forest resources; and in the relative contribution and financial value of processed forest products. Most countries in the region experienced a decrease in forest product trade between 2000 and 2002 (Table 21.2). Bhutan and Vietnam even changed from forest-product exporters to forest-product importers. These changes can likewise be explained by an increasing financial value of imported forest products and a decreasing value of exported forest products, suggesting a mounting shortage of locally produced forest products (see Table 21.2). The export of forest products in most South and Southeast Asian countries accounted for less than one percent of 2000–2002 GDP; the exceptions being Indonesia with forest products exports accounting for 3.26 percent of GDP, Malaysia – 3.20 percent, and Lao PDR – 2.63 percent (EarthTrends 2005).

Woodfuels (fuelwood and charcoal) production is the greatest among forest products in terms of volume in Asia (782 million cubic metres in 2002; see Table 21.3 for data on individual countries in South and Southeast Asia). However, woodfuels are produced primarily for local consumption, with only 22,480 m^3 of woodfuels (eight percent) traded internationally (FAO 2005). During 1990–2002 the per capita use of woodfuels declined in countries with higher GNI levels: specifically Indonesia, Malaysia, Philippines, Sri Lanka and Thailand. During the same period, the use of fuelwoods grew in the lower GNI countries: Bhutan, India, Lao PDR, and Myanmar (Tables 21.2 and 21.3). In the near future, it is expected that woodfuels consumption will remain stable, or even increase slightly, in lower GNI countries. While fuelwood use varies both between and within Asian countries, it is a common and important energy source not only for low-income rural and urban households, but also higher income households (FAO 2003a).

Table 21.3 Trends in volumetric woodfuel consumption, net trade in industrial roundwood, and production of major forest products for various South and Southeast Asian countries (1990 data: WRI 1994; 2002 data: FAO 2006)

Country/ region	Consumption[a] of woodfuels (‘000 m^3)		Net trade in industrial roundwood[b] (‘000 m^3)		Production of industrial roundwood (‘000 m^3)		Production of sawnwood (‘000 m^3)		Production of wood-based panels (‘000 m^3)		Production of paper and paper-board (‘000 m^3)	
	1990[c]	2002	1990[c]	2002	1990[c]	2002	1990[c]	2002	1990[c]	2002	1990[c]	2002
Bangladesh	30,061	27,763	–87	3	882	575	79	70	8	9	95	46
Bhutan	1,254	4,348	4	0	278	134	33	31	12	32	–	–
Cambodia	5,366	9,737	56	–	681	125	79	5	2	37	–	0
India	250,089	300,564	–1,118	1,990	24,421	19,308	17,460	7,900	442	645	2,202	3,973
Indonesia	141,017	82,556	1,245	(322)	26,804	32,997	9,549	6,500	8,837	12,635	1,432	6,995
Lao PDR	3,827	5,899	20	(63)	367	392	66	182	10	13	–	–
Malaysia	8,719	3,228	20,125	(4,762)	41,219	17,913	8,684	4,594	2,071	6,803	283	851
Myanmar	17,785	35,403	669	(877)	5,065	5,539	436	381	15	20	11	42
Nepal	17,661	12,728	4	0	583	1,260	470	630	–	5	9	13
Philippines	33,447	13,328	–276	433	5,019	3,079	845	154	455	620	212	1,056
Sri Lanka	8,364	5,774	0	0	674	694	12	61	10	22	17	25
Thailand	34,585	20,250	–1,444	688	3,154	7,800	1,123	288	340	705	868	2,444
Viet Nam	24,154	26,547	262	39	4,816	4,183	782	2,950	40	40	67	384
Asia	817,437	782,395	49,527	43,312	254,245	222,563	104,587	61,157	27,515	58,768	56,357	97,823

[a] woodfuel consumption equals woodfuel production for all countries listed suggesting no woodfuels are traded at the international market;
[b] positive values represent a net income derived from export of the product in question whereas negative values represent a net expenditure derived from net import of the product in question
[c] annual average of 1989–1991 data

Table 21.4 Trends in various forest management variables in South and Southeast Asia (FAO 2006)

Variables	S and SE ASIA (regional)			
	Annual change 1990–2005			
	%	Unit	Unit	Data availability[a]
Extent of forest resources				
Area of forest	–0.12	–2,669	'000 ha	H
Growing stock of forest	–2,01	–560	million m^3	H
Carbon stock in forest biomass	–2,69	–10,5	Gt	H
Biological diversity				
Area of primary forest	–2.08	–1,508	'000 ha	H
Area of forest primarily for biodiversity conservation	1.37	704	'000 ha	H
Total forest area[b]	0.80	1,113	'000 ha	H
Forest health and vitality				
Fire-affected forest area[c]	0.88	93	'000 ha	H
Disease affected forest area[c]	3.22	1.9	'000 ha	L
Insect affected forest area[c]	2.25	0.2	'000 ha	L
Area forest affected by other[c]	–2.50	n.s.		L
Productive functions				
Area of forest primarily for production	–0.55	–683	'000 ha	H
Area of productive forest plantations	1.92	195	'000 ha	H
Commercial growing stock	–3,05	–303	'000 ha	M
Total wood removals	–2.03	–3,666	'000 ha	H
Total NWFP removals	n.a.	n.a.	tonnes	L
Protective functions				
Area of forest primarily for protection	0.19	112	'000 ha	H
Area of protective forest plantations	1.46	63	'000 ha	H
Socio-economic functions				
Forest area under private ownership[c]	2.68	205	'000 ha	H
Forest area primarily for social services	0.79	1.2	'000 ha	H

M = the countries reporting data on variable represent together 50–75 percent of total forest area
L = the countries reporting data on variable represent together 25–50 percent of total forest area
[a]H = the countries reporting data on variable represent together 75–100 percent of total forest area
[b]total area of forest designated for conservation of biodiversity
[c]the data on annual change represent the period 1990–2000

Within South and Southeast Asia, there is a trend towards lower trade of unprocessed (or partially processed) forest products such as industrial roundwood and sawnwood (see Table 21.3) and a higher production and trade of processed forest products such as wood-based panels, paper and paperboard. Yet, the demand for all forest products, whether processed or not, is significant – and is projected to remain so, or even increase, from the local to international levels; with a growing number of countries being unable to meet their domestic demands. This projection stresses

the urgent need to expand the regional forest base, a process that should include afforestation, reforestation, and the establishment of other tree-based systems not normally including in forest system classifications. The latter comment refers to the recognition of smallholder agroforestry systems, and agroforestation.[3]

21.4 Tree-Based Land Use Systems

21.4.1 Natural Forests

For centuries natural forests have been the cheapest source of high-quality commercial timber and non-wood tree products. Additionally, hundreds of millions of people in the tropics depend on natural forests for a significant part of their livelihoods (Sayer 1998); most of these people practice traditional sustainable forest management practices. As discussed above, natural forests are rapidly being exhausted – reduced to an area of 266.5 million hectares in South and Southeast Asia (FAO 2005). The area of natural forests is not going to increase or meet human society's growing need for forest products and services. In face of persistent loss, the question remains how long can natural forests continue to fulfill a productive role? Van Noordwijk et al. (Chapter 20, this volume) argue that once the supply from natural forests dries up the price of tree products will increase making other *tree-based land use systems* profitable and attractive investments. Due to the time lag between tree establishment and tree product harvesting (even for fast-growing species) supply gaps will occur until planted tree-based systems become sufficient and in continuous production. Thus the pressure on natural forests will likely '*become worse before it becomes better*'. Van Noordwijk et al. (Chapter 20, this volume) recognize four important questions: (1) can deforestation be avoided or halted, (2) can the process of forest degradation be deflected to a tree-based land use pattern that avoids the more serious stages of environmental degradation, (3) can degraded lands (from a forest function perspective) be rehabilitated, and (4) to what new level of tree cover and forest functions can land use recover in a new 'steady state', while meeting economic expectations of the land managers as well as society at large. The first two points address the need to protect existing forest resource. The negative impacts of deforestation and forest degradation are heightening pressure on governments to protect their remaining natural forests (FAO 2005). Efforts should be made to conserve the shrinking natural forest resource, protecting the environmental services they provide and reserving them for sustainable management by indigenous people when appropriate. The sustainable management of natural forests systems has a significant role in providing the forest products and services people require, but that role can not be expanded given the shrinking resource. The following paragraph defines and

[3] Agroforestation is the establishment of smallholder agroforestry systems, and implies land rehabilitation through the establishment of a tree-based system and intensification of land management (Roshetko et al. 2007a).

discusses the role of sustainable forest management in meeting our needs for forest products and services. The third and fourth points above address, respectively, the rehabilitation of degrade lands, which are often former forest land; and how a combination of tree-based systems, both natural and planted forests, can be developed and sustained to meet society's needs. Both of these points are addressed throughout this chapter.

21.4.2 Sustainably Managed Forests

Sustainable forest management is 'the stewardship and use of forests and forest lands in a way, an at a rate, that maintains their biological diversity, productivity, regeneration capacity, vitality and their potential to fulfil, now and in the future, relevant ecological economic and social functions, at local, national and global levels, and that does not cause damage on other ecosystems' (FAO 2000). It is often referred to as having high potential for meeting society's demands for wood and non-wood products, as well as, environmental services (also see the Montreal Process on Criteria and Indicators for Sustainable Forest Management – SFM – discussed by van Noordwijk et al., Chapter 20 this volume). There remains much debate regarding whether sustainable management can actually save tropical forests. Some scientists (e.g., Rice et al. 1997) state that sustainable forest management (with focus on sustained yields of multiple services and products and longer-term production) generally provides lower returns and damages forests more than conventional timber harvesting (with focus on short-term timber supplies and short-term profits). Others claim (e.g., Pearce et al. 2003) that sustainable forest management, although generally less profitable than conventional logging approaches, performs better in terms of carbon storage and biodiversity conservation. The latter suggests sustainable forest management has high prospects in safeguarding forests and meeting society's multiple demands as values attached to forests and associated services rise over time. In an analysis of various landuse systems Tomich et al. (1998) confirmed that community-based sustainable management provided superior biodiversity, carbon storage, and rural social/livelihood services compared to commercial logging. A global study funded by USAID found that commercial logging is a common cause of forest conflict, with local communities against companies and government agencies (ARD 2004; Forester et al. 2004). Commercial logging frequently usurps legal traditional local rights and is the major cause of forest degradation in many areas (Lasco et al. 2001; Mittelman 2001; ARD 2004; Barr et al. 2004; Wulan et al. 2004; Forester et al. 2004; Sheng and Cannon 2004). Our view is that the academic argument over 'what is' sustainable forest management is moot. Sustainable management is the only viable option to conserve the world's dwindling natural forest resource, enabling natural forests to provide the environmental services that they are uniquely positioned to supply – biodiversity conservation, soil and water conservation, and carbon storage – and contribute strongly to healthy ecosystems, multiple socioeconomic benefits, and support of social/livelihood services to poor rural communities.

Moreover, there are many examples of forest degradation being deflected to a tree-based smallholder landuse pattern that avoids the more serious stages of environmental degradation. Good markets for tree products such as fruits, resins and latex have allowed a transition of substantial areas of southeast Asian forest into ‘agroforest’, a land use that combines ‘planted trees’ with forest flora and fauna, either retained or naturally regenerated vegetation (De Jong et al. 2001). Tree planting in these agroforests can occur in an open field stage, often in between food crops, or in small gaps or clearings in existing forest. The ‘miang tea’ agroforests of northern Thailand and some of the fruit tree, cacao and coffee agroforests originated from such ‘enrichment planting’, gradually modifying the species composition and forest structure without a clear felling stage. The rubber, damar (resin) and other fruit tree and coffee based agroforestry has been through such a clear-felled (usually ‘slash and burn’) stage, but recovered their tree cover and most of the forest functions, allowing a greater population density to make a living (about 50 persons km^{-2} for rubber agroforests, versus about 10 persons km^{-2} in sustainable forms of shifting cultivation or plantation forestry). When the first generation of planted trees gets old, the choice may again be either ‘interplanting’ or a new clear-felling + planting rotation. In Indonesia, farmers use different words for these two ways of planting trees (*sisipan* versus *tanam*) (Joshi et al. 2002). The term ‘plantations’ in Southeast Asia generally refers to a form of ‘land clearing’ (conventionally ‘slash and burn’, with various forms of ‘slash and mulch’ or ‘controlled burning as more recent alternatives) to form a break with the preceding vegetation. Both from an economic and an environmental perspective, however, the ‘enrichment planting’ approach merits further interest.

21.4.3 Forest and Tree Plantations

In this section we focus on industrial, communal or individual forests or plantations established by planting and/or seeding through afforestation or reforestation activities, which are even aged stands of 1–2 species established at regular spacing (FAO 1998). As discussed above, plantations form an important and efficient source of wood and non-wood products and by reducing production pressure may have a tempering effect on the rate of natural forest loss. Yet, large scale forest plantations are a main cause of natural forest conversion and lost (ARD 2004; Barr et al. 2004; Forester et al. 2004; Sheng and Cannon 2004). Additionally, as mentioned above, forest plantations, particularly monocultures, provide limited genetic and biodiversity conservation, ecological resilience, and carbon storage services (Michon and de Foresta 1995; Lamb 1998; Murdiyarso et al. 2002; Roshetko et al. 2007a; van Weerd and Snelder, Chapter 16, this volume); and as with commercial logging of natural forests, tree plantations provide less social and livelihood services to rural communities than community managed forests and agroforestry systems (Tomich et al. 1998). Moreover, forest plantations have not been equally successful across the region; efforts to promote plantations regularly fail to achieve the expected targets and results (Moestrup 1999; Lasco et al. 2001; Lasco, Chapter 9, this volume; Barney, Chapter 13, this volume). This includes areas

where timber is ‘cleared’ to provide short-term economic returns, without plantations being established (Barr et al. 2004; Sheng and Cannon 2004). When established many forest plantations operate on the premise that there are economies of scale in the planting, managing and harvesting of *trees*. In fact, the ‘economies of scale’ may derive from harvesting, marketing and processing stage and from regulatory frameworks or subsidized credit directed to large operators (Barr 2001, 2002).

Tree plantations are a paradox. They are an important and efficient source of wood and non-wood products, but are also a main cause of forest conversion and the loss of environmental services provided by those natural systems. A plantation strategy is required that maximizes their good characteristics and limits their negative impacts. Across the tropics there are large areas of deforested land in different degrees of degradation. Priorities should target degraded lands that can support tree plantations. Policies forbidding forest conversion should be strictly enforced. Government subsidies for plantation establishment should be restricted to those achieving land rehabilitation. Criteria for these measures should be developed at the national level. To avoid conflict, local communities should be informed of plantation establishment plans and given opportunity to provide input. More effective would be the simultaneous development of corporate-community plantation partnerships (FAO 2003b). Those partnerships are addressed in more detail below.

21.4.4 Smallholder Tree-Based Systems

Here we refer to land use systems that include natural forests, planted tree-based systems and systems that are a combination of both. For the purpose of our discussion the term and concept are interchangeable with *smallholder agroforestry systems*, which are small landholdings or parcels managed by individuals or groups of farmers. Depending on local needs or opportunities, smallholder systems may focus on tree crops, agricultural crops, livestock or a combination. These various systems will differ greatly in size, species component, tree density, tree longevity, and management intensity (Roshetko et al. 2007a). A shortage of local forest resources is often the catalyst of spontaneous expansion of smallholder agroforestry systems. This type of farmer-led spontaneous smallholder agroforestry development has occurred in Bangladesh (Byron 1984); Sri Lanka (Gunasena 1999); the Philippines (Luzon: Pasicolan and Tracey 1996; Schuren and Snelder, Chapter 3, this volume; Cebu: FAO 1993; and Mindanao: Magcale-Macandog et al. 1999); Kenya (Scherr 1995; Place et al. 2002); and Indonesia (Sumatra: Michon and Bompard 1987). In addition, proximity to urban centres creates high demand for timber, fruit and other forest products and stimulates spontaneous smallholder agroforestry. This is particularly true for areas far away enough from the extractive forest frontier and/or with large enough farms to support tree crops in addition to seasonal cash crops (Schuren and Snelder, Chapter 3, this volume). In other situations (e.g. in central and east Java) the (temporary) migration of the young people to cities results in extensification of land use with tree farming as a form of a ‘living

savings account'. Under these conditions, smallholder farmers see tree farming as a means to diversify their production, reduce risk, and build assets to enhance family incomes and security (see also Schuren and Snelder, Chapter 3, this volume).

Smallholder farmer tree planting systems are generally successful. Smallholders have limited time and financial resources. The trees they plant represent a conscious investment for which other options have been forfeited. Farmers generally restrict plantings to the number of trees that can be maintained and integrate *tree growing* with their crop and animal production activities. The management practices undertaken to assure good food crop yields – cultivation, weed control and fertilization – also benefit their trees. The available land, labour, and other resources are allocated according to the farmer's objectives. Because landholdings are small, farmers can select the farm niches most appropriate for tree production. The combination of limited resources, small individual plantings, and intimate familiarity with the planting site result in high tree survival and good growth rates. In summary, smallholder tree-growing activities benefit from intensive management over limited areas and vested self-interest – the desire of the farmer to profit from her/his investment of time and resources.

Smallholders with diverse, risk-averse farms that include a significant tree component could be efficient tree producers of the future. Their tree farming systems have high potential to yield both wood and non-wood products and play an important role in the reforestation of degraded lands. Smallholder tree-based systems hold potential as one component of a general poverty alleviation strategy for agrarian-based poor rural communities (Krol 1992; Michon and Mary 1994; Roshetko et al. 2007a; Snelder, Chapter 2, this volume). Although the potential of tree-based systems for poverty alleviation has not been fully exploited and the extent to which these systems can alleviate poverty and enhance food security is poorly documented, the importance and potential of smallholder tree-based systems will continue particularly with the continued development of market-economies and rural infrastructure (Roshetko et al. 2002a).

To summarize, our experience is that under the right conditions smallholder farmers can and will cultivate a wide range of tree species as a component of their efficient, integrated and risk-averse livelihood and land-use systems and will effectively respond to the increased demand for wood and other tree products. To harness the potential of smallholder farmers, a *paradigm shift* is required in the forestry sector, to recognize and support farmer-led approaches to tree-based farming systems as part of the solution to achieve sustainable forest management objectives.

21.5 Technical Assistance to Support the Development of Smallholder Agroforestry Systems

Although smallholder agroforestry systems hold potential to meet demand for market products and provide household income, they have not been developed in an equally successful manner/way throughout the region. Experience indicates that besides a shortage of forests and market demand for tree products, the following factors have strong bearing on the successful development of smallholder agrofor-

estry systems: (i) secure land tenure and land use conditions; (ii) supportive policy conditions; (iii) access to and knowledge regarding the management of quality germplasm; (iv) tree management skills and information; and (v) adequate market information and linkages (Roshetko et al. 2007b).

The first two factors, land tenure and policy support, are the basic enabling conditions required to facilitate the development of smallholder systems. Developing supportive tenure and policy conditions often requires broad-based negotiations which include participation from local, regional and national governments as well as the private sector and community organizations. A central part of such negotiations is determining just what issues require careful regulation (Fay and Michon 2005); with successful negotiations leading to consensus land management agreements and natural resource security for local farmers. More detailed decisions regarding land tenure and policy support are found below.

The other three factors: quality germplasm, tree management and market linkages, are technical issues that can be effectively addressed at the local level by government extension agencies, non-government organizations (NGOs), farmer organizations and/or individual farmers – once the enabling conditions are satisfied. Scientific research is an important means to compile and generate tree management specific technology specific for smallholder conditions and would otherwise not be available to farmers. Examples include, the studies on the alder-based cardamom agroforestry systems in eastern Himalaya, India (Sharma et al., Chapter 18, this volume) and studies how to manage the '*Imperata* regrowth window' best (i.e., the period between the cessation of food-crop interplanting and tree canopy closure which controls *Imperata* regrowth), for a range of planting patterns and tree species in Lampung (Indonesia) and northern Mindanao (the Philippines; van Noordwijk et al., Chapter 20, this volume). Moreover, efforts should be made to link smallholders with sources of quality germplasm (the formal seed sector) and technical support to effectively manage nurseries and agroforestry systems. This should include the implementation of nursery and system management training activities, linkages with *effective* institutional technical support, and the development of a cadre of farmer technical specialists. Training and participatory nursery development are proven methods of building farmers awareness, leadership, and technical skills; and independence regarding germplasm quality, production and management capacity (Koffa and Garrity 2001; Roshetko et al. 2004; Carandang et al. 2006). Specifically the development of farmer-to-farmer extension capacity is an important step towards helping local communities to create viable market-oriented smallholder agroforestry systems (Roshetko and Yuliyanti 2002; Roshetko et al. 2007b). Some strategies for strengthening market-orientation and market linkages for smallholder systems are discussed in the following section.

21.6 Strategies for Market Orientation

Access to existing markets has also been found to be a vital criterion for the development of market-oriented smallholder agroforestry systems (Scherr 1995, 1999; Potter and Lee 1998; Landell-Mills 2002; Tukan et al. 2006; Manivong and Cramb,

Chapter 5, this volume). This might be more easily accomplished for high-value, high demand products such as agarwood (Heuveling van Beek and Persoon, Chapter 12, this volume) or cardamom (Sharma et al., Chapter 18, this volume), both of which are cultivated in forests and smallholder systems. Unfortunately, smallholders generally have weak market linkages and poor access to market information (Hammett 1994; Arocena-Francisco et al. 1999; Snelder et al. 2007). Successful strategies to orient smallholder systems with market demand at the local, provincial, national or international levels may vary in name, structure, intensity and approach. They all share the purpose to identify or quantify market demand and focus smallholder systems to produce products that meet that market demand. Here we discuss four such strategies: rapid market appraisals, the reforestation value chain, the certification of smallholder wood products, and equitable corporate-smallholder partnerships. All four strategies are flexible to address the conditions of target markets and local smallholder systems. Other similarities exist; a locally evolved approach may incorporate characteristics of any of the four and other strategies.

21.6.1 Rapid Market Appraisals

Experience demonstrates that besides weak market linkages, and perhaps because of that limitation, smallholder farmers often: produce products of unreliable quality and quantity, that do not match market specifications; rarely engage in grading and processing to improve product quality and value; and sell their products opportunistically as individuals – not through groups to achieve economies of scale (Roshetko and Yuliyanti 2002b; Roshetko et al. 2007b). These shortcomings can be documented and addressed through market surveys conducted using rapid survey formats (e.g., ILO 2000; Betser and Degrande 2001). Such rapid market appraisals (RMAs) seek to identify and understand: (i) the agroforestry species and products that hold potential for farmers (their specifications, quantities, seasonality, etc.); (ii) the market channels that are used and hold commercial potential for smallholder products; (iii) the marketing problems faced by farmers and market agents; (iv) the opportunities to improve the quantity and quality of farmers' agroforestry products; and (v) market integration (through vertical price correlation and price transmission elasticity) and efficiency (Roshetko and Yuliyanti 2002; Roshetko et al. 2007b).

RMAs are iterative processes. They utilize relevant information gathered from participatory approaches (both individual and group discussions) with all relevant stakeholders (farmers, collectors, dealers, processors through to the consumer), direct observation, detailed surveys, and secondary data sources. This iterative feature and the utilization of multiple sources allow all the information and data to be reviewed and checked for accuracy. Once results are consistent a summary of 'farmer marketing conditions and priorities' (priority species, marketing channels

and agents, farmers' market roles, marketing problems, and opportunities) can be finalized and shared with all relevant stakeholders. Work plans are developed to identify and agree on actions that farmers, market agents and other stakeholders can take to improve the production and marketing of smallholder products. Work plans promote win-win conditions that will benefit farmers, market agents and other involved stakeholders (Roshetko et al. 2007b).

21.6.2 The Reforestation Value Chain

As demonstrated by various examples in this volume, a common failing of project-based tree planting initiatives is the short-sighted time frame and narrow focus. In many instances, farmers were encouraged and assisted to plant trees only to be frustrated by their inability to sell their tree products for a variety of reasons (e.g. low price, lack of market, lack of processing technology). This experience has left many farmers disillusioned by the false promise made by project implementers (Bertomeu, Chapter 8, this volume; Tolentino, Chapter 15, this volume). In spite of numerous failures, government agencies, donors and their partners continue to finance short-term tree farming and reforestation projects. An unforeseen backlash is that some farmers and communities may refuse to cultivate trees altogether.

To remedy this, Lasco (Chapter 9, this volume) proposes the use of the reforestation value chain (ReV Chain) which considers all the key stages in the tree farming process from land tenure to tree planting through marketing. In essence, the ReV Chain strategy acknowledged and accepts that a longer time horizon is needed for tree farming projects to succeed. This approach is best used from the project planning stage, so that the expertise and inputs required throughout the project and across the chain of activities can be provided. This requires the early involvement of all relevant institutions and individuals to not only provide relevant input, but also to help identify – and accept – their role, including contributions, responsibilities and benefits.

Most successful smallholder tree farming projects in the Philippines incorporated long-term and holistic approaches that are essential elements of the ReV Chain. For example, in the 1970s, the Paper Industries Corporation of the Philippines (PICOP) encouraged farmers in Mindanao to plant *Paraserianthes falcataria* for pulpwood (Tagundar 1984; Bertomeu, Chapter 8, this volume). PICOP provided technical assistance to farmers and guaranteed purchase of the wood biomass. Smallholder tree farms expanded quickly under this scheme. By 1997, there were 15,000 ha of tree farms in close proximity to PICOP's mill site and another 29,000 ha at further distances that sold wood to PICOP (Jurvélius 1997). In spite of some serious limitations, the PICOP tree planting partnerships with farmers is also good example of how private sector involvement can support the development of smallholder tree farming (Chokkalingam et al. 2006).

21.6.3 Certification of Smallholder Wood Products

A major challenge facing policy makers worldwide today is the development of appropriate policy instruments and regulations to address the pervasive improper and unsustainable exploitation of the world's natural forests. One such policy instrument is the certification of forest practices and derived products. Certification can be important for the range of stakeholders mentioned in RMA and ReV Chain subsections. Increasingly, market premium for certified products provide incentives for tree growers and forest owners to seek certification for their management practices and forest products. Certification is also increasingly forced upon producers through threats of boycotts by activists, buyers, and consumers.

Whereas the tendency towards sustainable forestry certification is true for developed countries, conditions in developing countries are less conducive to forestry certification. In a study addressing the global perspective on why countries certify, van Kooten et al. (2005) report that, in addition to factors such as forest export and GDP, the presence of politically, economically and socially advanced institutions has a positive effect on the likelihood that forest growers will seek certification voluntary. In addition, their results show that gender is a major factor in explaining countries' inclination to certify forest practices. In countries where women have little or no effective voice in civil society, the likelihood that tree growers and forest owners will seek certification is significantly reduced. Women in developing are mostly affected by environmental degradation and therefore more inclined to contribute to protective measures. If women's voices are hardly heard, concerns about the environment and need for environmental protection receives less attention (van Kooten et al. 2005).

Udo de Haes et al. (Chapter 10, this volume), using the Philippines as a case study discusses sustainable forestry certification for smallholder tree growing in developing countries. They conclude that there is potential for the certification of smallholder producers given that the market specifications for high-quality lumber can be met. This possibility is linked to providing smallholder access to the quality germplasm and technical assistance summarized above and details by Roshetko et al. (2007a, b). Once successfully implemented, certification of smallholder systems will create opportunities for value-adding wood processing activities that, in turn, will diversify perspectives with regards to rural economies. Other niches at the international market can be tapped, generating more income, where international consumer needs and standards are met. Before reaching this stage in sustainable forestry development, however, actions must be taken towards organizing the market and finding donor and government support in order to undertake such transition process (Udo de Haes et al., Chapter 10, this volume).

21.6.4 Equitable Corporate-Smallholder Partnerships

As discussed above, demand for forest productions continues to increase as the world human population and incomes grow. The world's area of natural forest is

shrinking and there are global trends to reserve areas of natural forests for conservation purposes. Forest plantations are an effective and efficient means of producing forest products. These systems must compete with other landuse options to meet economic, social and environmental concerns. It is increasingly important that besides providing economic returns to their investors, forest industry operations should also provide opportunities for adjacent communities to enhance their livelihoods. Equitable corporate-smallholder partnerships can address these issues.

Corporate partnerships that establish agreements for industry to purchase wood produced by other entities (smaller corporations, groups or individual) are now well established and growing rapidly. Some of these partnerships are large and focus primarily on biomass production; others are small and concerned with meeting multiple objectives. Equitable corporate-smallholder partnerships function on the basis of empowering smallholders or communities in negotiation and management processes and provide economic returns based on the invested equity. The smallholders and corporations are business partners. Partnerships are based on sound financial and business principles, but with indicators for equitable social and environmental criteria (FAO 2003b). Based on negotiation and agreement, the form of the partnership may vary, with the roles, responsibilities, and returns for each partner varying accordingly. Smallholders could serve solely as landowners providing their land to the corporation, or they could be responsible for establishing and managing tree crops under regimes negotiated with the corporation. Through a series of field projects, an international workshop, and subsequent synthesis FAO, CIFOR and other partners have developed a set of guidelines that enable and support the development of viable *equitable corporate-smallholder partnerships*. The guidelines enable stakeholders to address, in a substantive and transparent manner, negotiations towards economic, financial, social, and environmental sustainability. Policy issues are also addressed. A framework is provided to facilitate joint action learning between smaller landowners, companies, research and extension agencies, non-government organizations (NGOs), and other stakeholders that leads to greater equity in negotiation, and as a consequence, greater opportunities for social and ecological sustainability. Further field testing of the guidelines under a broader range of conditions is required and being conducted. Some corporate partners have expressed interest in having the guidelines/framework recognized as an international accreditation scheme, after further testing and development (FAO 2003b).

21.7 Environmental Services

While smallholder tree-based systems are typically less diverse than native forest, they may act as a catalyst for recovery of degraded habitats into naturally regenerating forest with higher biodiversity conservation value (provided hunting is banned and native species are added to the stands; van Weerd and Snelder, Chapter 16, this volume) or contain a much greater number of plant and animal species than most large-scale forest plantations; the latter is particularly true for the so-called

agroforests (Michon and de Foresta 1995; Murdiyarso et al. 2002). This diversity can, at times, provide ecological resilience and contribute to the maintenance of beneficial ecological functions. Participation by local communities in forest, including agroforest, management is often critical to successful forest conservation (Suyanto 2006; Tarigan et al. 2007). Agroforests, similar to plantations, are "working forests" and they can help relieve some of the pressure to harvest native forests (although their presence as such is not a sufficient condition for protection of old growth forests (Angelsen and Kaimowitz 2001; Michon and Bompard 1987; Tomich et al. 2001; Tomich and Lewis 2001). Linked systems of upland and riparian tree-based buffer systems, designed in regards to other landscape practices and features, can optimize soil and water conservation in the watershed (van Noordwijk et al. 1998), along with other economic and social services. Much of the opportunity to store carbon through afforestation will occur on agricultural lands due to the vast land area devoted to agriculture throughout the world (Brown et al. 1996; Watson et al. 2000; Smith and Scherr 2002).

In societies where the majority of people live in (sub)urban areas, concerns over the accelerating loss of open and green space tend to become prominent. This is a quality-of-life issue to many and raises the potential for agroforestry applications at the agricultural/community interface to restore ecological functions that provide for storm water management, wildlife habitat, recreational opportunities, and aesthetic enhancements.

Converting environmental services (ES) of tropical forests from public goods to tradable services is a promising strategy in safeguarding forests' ecosystem functions and services in tropical regions and elsewhere. Yet, the development of markets for such services depends on the various actors that operate within this marketing field and the criteria they use for engaging in tropical forestry projects providing environmental services. For example, Sell et al. (2006) conducted a survey among experts of 45 institutions in Latin America and Europe, representing various key market-actor groups of, respectively, the supply side (developing countries) and the demand side (developed countries) in terms of markets for environmental services. They found that experts from Latin America emphasized criteria related to markets and information/knowledge management whereas experts from Europe put more emphasis on social and environmental benefits and sustainability. These variances likely reflect the differences in social-economic development of the respective regions. It is equally likely that similar differences exist between experts from Asian and European institutions, suggesting there is a need for developing appropriate support mechanisms and enabling conditions in order to match criteria and facilitate tradable environmental services in developing countries. The latter is also true when addressing the question of how to integrate the role of smallholder tree growing in environmental services.

In a recent provocative piece Wunder (2007) suggests that smallholder communities are not the most likely beneficiary of most environmental service programs. The most likely beneficiaries are those who currently practice unsustainable management or represent a potential threat to the environment. Smallholder communities who already practice sustainable management are not likely to attract

environmental payments, as those payments would not result in additional environmental services. Additionally, an environmental services program involving communities of smallholders would have high transaction costs and thus be less attractive to investors. The tier system discussed by Lasco et al. (Chapter 17, this volume) makes distinctions regarding how environmental service payments are justified and determined. The system acts as a guide in comparing the quality of the environmental services offered for "sale" by various projects or providers; increasing competition between buyers and sellers. Such sobering analysis demonstrates that environmental service programs are not necessarily beneficial to smallholder communities. Many efforts may have negative impacts for local communities, particularly the poor, by restricting land access or landuse options. Unless local residents receive additional benefits, they are not likely to accept restriction on their current activities or options. Such a logical response threatens the success of environmental services program. It is important to identify the enabling conditions that will favor a flow of local benefits from an environmental service program, thus facilitating program success. Reviewing various types of smallholder tree planting systems to address carbon storage, Roshetko et al. (2007a) identify four enabling conditions that are of universal application to all environmental service programs: integrated planning and project design; establishing clear, stable and enforceable rules for access to land and trees; managing high transaction costs; and ensuring dynamic flexibility for co-generating other environmental services. Their discussion is summarized here along with additional relevant citations.

21.7.1 Integrated Planning and Project Design

Smallholders invest in trees as one component of their overall on-farm and off-farm income/livelihood generation system. The following factors are found to be positively correlated with successful smallholder tree planting activities – adequate food security; off-farm employment; sufficient household labor; higher education levels; access to land that is not needed for food crop production, and lower risks (Predo 2002; Yuliyanti and Roshetko 2002; Tyynela et al. 2002; Schuren and Snelder, Chapter 3, this volume; Barney, Chapter 13, this volume). As smallholders are not likely to be solely interested in environmental services, such a program should integrate its activities into the household's and community's broader development plans (Bass et al. 2000; Desmond and Race 2003; Tyynela et al. 2002), particularly agriculture and agroforestry productivity. Efforts should be made to identify the community's development priorities, even when such priorities do not formally exist. While an environmental service program might not be able to directly address priorities regarding infrastructure, health care or education, it should show awareness of these issues and when possible provide support or at least not impede those priorities. The program should also help to strengthen community institutions and build their capacity in relation to: agroforestry;

negotiations; planning and leadership, and possibly in the concepts of environmental services (CIFOR 2000; Tipper 2002). In the long-term, this type of community-level capacity building may be the most significant contribution to the development of a successful, low-cost smallholder tree planting process that supports local livelihoods and environmental services (Roshetko et al. 2007a).

21.7.2 Establishing Clear, Stable and Enforceable Rules for Access to Land and Trees

Clear land tenure and tree use rights are imperative for the successful implementation of any tree planting activities or environmental service program (Scherr 1995; Scherr 1999; Potter and Lee 1998; Desmond and Race 2000; Predo 2002; Tomich et al. 2002; Yuliyanti and Roshetko 2002; Barney Chapter 13, this volume; van Noordwjik et al. Chapter 20, this volume). Without guaranteed rights to utilize the trees, smallholders are not likely to plant nor tend trees. Delineating and defining land and tree access rights, whether individual or commonly held, must be a high priority for the program. Securing tenure rights can be one reward resulting from the program; however it should not be the only 'carrot' to get people to plant trees. Tenure rights must be part of a wider negotiation process that addresses the communities' broader development needs. Such a negotiation process should be a fundamental part of the project design, as discussed below (Roshetko et al. 2007a).

21.7.3 Managing High Transaction Costs

A successful environmental services program will require close collaboration between various types of partners – program staff, governments (both local and national), communities of smallholder farmers, and independent local institutions. All parties should be treated as equals and actively participate in the project design. The objectives and activities of the project, as well as the responsibilities and benefits of each party should be determined through negotiation – not unilaterally set (Brown et al. 2001; Desmond and Race 2000; Mayers and Vermeulen 2002; Tyynela et al. 2002). This negotiation process must be participatory, transparent and agreeable to all partners. Specifically, farmers must understand the services they are providing and agree with the benefits they are to receive. The terms of engagement should be equitable, realistic and formalized in a legal contract. It is likely that there will be misunderstandings and conflicts. Thus, the contract should be flexible and renegotiable (CIFOR 2000; Desmond and Race 2002; Tyynela et al. 2002; Fikar 2003). With these requirements and the likely engagement of numerous smallholder farmers, the single largest hindrance to program development is high transaction costs that include: (a) the costs associated with making information (e.g., on technology, markets and market players) accessible to multiple clients; (b) facilitat-

ing and enforcing smallholder agreements; and (c) designing feasible monitoring systems. While these (high) costs are justifiable as the *extra costs* required to achieve more equity and welfare, they are not likely to be underwritten by investors who are primarily interested in an environmental service and may have other investment options. Thus, to attract investors to smallholder-oriented program, co-funding mechanism are needed such as multilateral or bilateral support to cover the higher costs that assure significant social benefits (CIFOR 2001; Wunder 2007).

21.7.4 Ensuring Dynamic Flexibility for Co-generating Other Environmental Services

The development of various smallholder agroforestry systems is likely to generate more than one environmental product and service, such as biodiversity conservation, eco-tourism, carbon sequestration, and watershed protection. These services generate benefits to different sectors of society, and as such, could warrant payments to reduce scarcity and ensure sustainability. Markets for these environmental services are in different stages of development and it is necessary to assure that they benefit smallholders. The development of pro-poor payments for any of these environmental services requires the same enabling conditions. Hence, program design, tree product marketing, tenure arrangements, and institutions for underwriting transactions costs need to be flexible to allow for the inclusion, addition, of the multiple products and services generated by the same tree-based systems (Roshetko et al. 2007a).

21.8 Institutional and Policy Support

Institutional changes and a better understanding of communities, their needs and perceptions, are clearly imperative if smallholder tree growing activities are to successful support sustainable forest management and contribution to livelihood development. Within this context, Kant and Berry (2005) point at the need for institutional analysis that takes into account interactions between both factors of internal relevance to institutions (i.e., the rules, norms, and codes that, whether formal or informal, define the rights, privileges and obligations of various groups under a regime) and organizations (i.e., the physical manifestations of institutions) as well as factors of external relevance (i.e., the “external setting” defined by social, economic, environmental, and international features). Their recommendation is based on an analysis of failed forest regimes in India: the ineffectiveness of past forest regimes proved to be related to the non-complementarities between formal (government-based) and informal (local, community-based) institutions, leading to adaptive inefficiency, and the unconstructive organizational culture and perceptions of forestry organizations’ members. Organizational inertia appeared to be one of the main factors impeding institutional changes in this case and, thus, institutional

change alone, without complementary change in the attitude of member of forestry organizations and organizational culture, failed to provide the desired results.

Similar conclusions may apply to the smallholder tree-growing constraints in the case studies referred to in this book. Policy and management prescriptions for sustainable forest management should address the institutional and organizational aspects and the external setting in an integrative manner. Hence, a clear challenge lies in the development of supportive institutions and organizations together with a fundamental policy rectification that can lay a basis for a free and fair tree product market making smallholder tree-growing systems more sustainable and equitable.

21.9 Lessons from the Philippines and Implications for Other Asian Countries

Several lessons emerge from the papers presented in this volume. First, the Philippine experience has shown that smallholder tree farmers in developing Asian countries are capable of producing large quantities of timber and they can efficiently supply local, national and international markets (Bertomeu, Chapter 8, this volume). There is a caveat to this however. Government agencies and NGOs who promote tree farming must be careful not to oversell its financial benefits. Experience from other countries stress that appropriate technical support most also be provided (Roshetko et al. 2007a; Manurung, Chapter 4, this volume). Farmers may feel short-changed when the expected financial windfall does not happen. This may lead to disenchantment with tree farming and could make it harder to convince farmers to go into it in the future. Another important lesson is that market forces need to be taken into account in promoting tree farming and the kind of species to plant. There is a tendency to focus only on a few species because of a number of reasons (fast growth, readily available planting materials, high survival rate, high demand at the time of planting). This could result to oversupply driving the prices down.

Second, bioeconomic analysis showed that tree-based land use systems have significantly higher financial profitability and environmental benefits than pure cash crops (Predo and Francisco, Chapter 14, this volume; Snelder et al. 2007). However, the risk of tree farming appears to be higher as reflected in the wider variation of economic returns which could prove to be a significant barrier to small farmers who are typically risk-averse. There is therefore a need to find ways to mitigate the risk. One way of doing this is to diversify income sources from tree farms. New opportunities such as payments for carbon sequestration should be explored.

Third, while most tree farms rely on exotic species, there is a rising interest in the use of indigenous species for tree farming (Tolentino, Chapter 15, this volume). The current interest in biodiversity conservation provides additional incentives for planting indigenous species. However, significant constraints remain such as the supply of quality germplasm, lack of information of cultural management, and

unstable forest policy. There is a need to evaluate which of the numerous indigenous species in tropical countries should be prioritized for research and development. Preliminary works for the Philippines, Indonesia, Vietnam, Thailand and Southeast Asia in general have been completed (Roshetko and Evans 1999; Gunasena and Roshetko 2000).

Fourth, the Philippine government should remove policy restrictions curtailing the use of planted trees and provide incentives appropriate to smallholder farmers (Bertomeu, Chapter 8, this volume; Masipiqueña et al., Chapter 7, this volume; Chokkalingam et al. 2006). The Philippine government has been slow in acknowledging the importance of timber production by smallholder farmers. Existing policy disincentives constrain the establishment of tree farms and the use of trees by the wood processing industry. These include permits and regulations governing cutting and transport of farm-grown trees. Current policies favor big commercial tree farms and utilize terminology relevant to natural forests – although harvesting in natural forests is now widely banned. Efforts must be made to simplify policies and provide other incentives for smallholder farms. At the same time, farm forestry extension programs should invest in training programs aiming at improving management and marketing.

21.10 Conclusion

The papers in this volume demonstrate that smallholder tree-based (agroforestry) systems play significant roles in the livelihoods of local communities, yield both wood and non-wood products for commercial markets, and provide environmental services for the public good. The importance of smallholder systems will continue to increase as the global forest resource shrinks further and human populations expand. Yet, smallholder systems are ignored in formal definitions, statistics, and legal/institutional frameworks. The messages of this chapter and the entire volume are that there is a clear need for a paradigm shift in the forestry, development, and extension sector to:

1. Recognize the contribution and importance of smallholder agroforestry systems *as part of* the solution to achieve sustainable forest management and production objectives
2. Adopt more holistic and sustainable strategies to support and strengthen the market orientation of smallholder agroforestry systems
3. Provide technical support to smallholder farmers that enable them to improve their success, productivity, and profitability of their agroforestry systems
4. Develop supportive institutions (rules and organizations) together with a fundamental policy rectification which would lay a basis for sustainable and equitable regional tree product markets
5. Implement enabling conditions that support the success of smallholder agroforestry systems and their potential to provide environmental services

An additional overarching message is that natural forests, forest and tree plantations, sustainable management, and smallholder agroforestry systems all have a

vital role in stabilizing and expanding a new level of tree cover and forest functions that meet economic, social, and environmental expectations of land owners/managers and broader human society.

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